CLAIMS

WHAT IS CLAIMED IS:

1. A hybrid microlens, comprising two layers that are transparent at the wavelength of interest:

   a first layer with a low index of refraction;

   a second layer bonded to said first layer; and

   said second layer having an optical focusing element formed on the non-adjacent surface, said second layer being substantially thinner and having a higher index of refraction than the first layer, whereby both the microlens sag and the sum of the two layer thicknesses are minimized.

2. The hybrid microlens of claim 1 wherein said optical focusing element is a refractive microlens.

3. The hybrid microlens of claim 1 wherein said optical focusing element is formed by dry etching.

4. The hybrid microlens of claim 1 wherein said first layer comprises fused silica or optical glass.

5. The hybrid microlens of claim 1 wherein said second layer is a semiconductor.

6. The hybrid microlens of claim 1 wherein said second layer is comprised substantially of silicon.

7. The hybrid microlens of claim 1 wherein an antireflection layer is applied at the interface between the first and second layers, and said antireflection layer is optimized for the refractive indices of the two adjacent layers.

8. The hybrid microlens of claim 1 wherein said second layer is divided into a plurality of

Sub A3 cont'd

portions ~~for reduced mechanical stress in the layer.~~

9. The hybrid microlens of claim 1 wherein said bonding process is via epoxy.

10. The hybrid microlens of claim 1 wherein said bonding process is via anodic bonding.

11. An optical construction which substantially reduces return signal from an optical fiber, which is perpendicular to and butt-coupled to a planar optical surface, comprising:

A small non-perpendicular surface formed on said planar optical surface in the vicinity of the core of said optical fiber, whereby optical reflection from said non-perpendicular surface is directed away from said optical fiber.

12. The optical construction of claim 11 and further comprising an optical epoxy that fills the gap between the optical fiber end face and the adjacent non-perpendicular surface, said optical epoxy having an index that approximately matches that of the optical fiber to reduce optical loss and minimize polarization sensitivity.

13. The optical construction of claim 11 wherein said non-perpendicular surface is approximately a planar surface.

14. The optical construction of claim 11 wherein said non-perpendicular surface is formed by dry etching.

15. The optical construction of claim 11 wherein said optical fiber end face is not perpendicular to the fiber longitudinal axis.

Sub A4

~~16.~~ A method for making a plurality of hybrid microlenses, comprising the steps of:

Anti-reflection coating a second layer;

Bonding ~~the~~ second layer to a first layer which has a lower index of refraction than the second layer;

Thinning and polishing the second layer;

Forming a plurality of optical focusing elements on the non-adjacent surface of

the second layer.

Sub A (cont'd)

17. The method of claim 16 wherein said optical focusing element is a refractive microlens.

18. The method of claim 16 wherein said optical focusing element is formed by dry etching.

19. A method for substantially reducing optical return signal from an optical fiber, which is perpendicular to, and butt-coupled to a planar optical surface, comprising the steps of:

forming non-perpendicular local surfaces on said planar optical surface in the vicinity of the core of said optical fiber;

angle cleaving or angle polishing said optical fiber end face;

filling the gap between said optical fiber and said non-perpendicular local surface with an optical epoxy having an index of refraction that approximately matches that of said optical fiber.

20. The method of claim 17 wherein the step of forming non-perpendicular local surfaces is by dry etching.

ADD AS 7